ARTICLES IN CURRENT PERIODICALS.

Acta Mathematica, volume 42, no. 3, 1919: "Gaston Darboux (1842–1917)" by D. Hilbert, 269–273 ["Traduction du discours prononcé le 12 mai 1917 à la séance publique annuelle de l'Académie des sciences de Goettingue (*Nachrichten der K. Gesellschaft der Wissenschaften zu Göttingen*, 1917, p. 71)"]; "Darboux's Anteil an der Geometrie" by L. P. Eisenhart, 275–284 ["Uebersetzung der am 6. September 1917 vor der vereinigten Sitzung der 'American Mathematical Society' und der 'Mathematical Association of America' in Cleveland gehaltenen Vorlesung (*Bulletin of the American Mathematical Society*, volume 24, 1918, p. 227)"].

American Journal of Mathematics, volume 41, no. 4, October, 1919: "The ten nodes of the rational sextic and of the Cayley symmetroid" by A. B. Coble, 243–265; "Functions of matrices" by H. B. Phillips, 266–278; "On the Lüroth quartic curve" by F. Morley, 279–282; "On the order of a restricted system of equations" by F. F. Decker, 283–298; "On the Lie-Riemann-Helmholz-Hilbert problem of the foundations of geometry" by R. L. Moore, 299–319.

Bulletin of the American Mathematical Society, volume 26, no. 3, December, 1919: "Note on convergence tests for series and on Stieltjes integration by parts" by R. D. Carmichael, 97–102; "Note on a physical interpretation of Stieltjes integrals" by R. D. Carmichael, 102–105; "A derivation of the equation of the normal probability curve" by W. D. Cairns, 105–108; "Bôcher's boundary problems for differential equations" [review of M. Bôcher's *Leçons sur les Méthodes de Sturm dans la Théorie des Equations Différentielles Linéaires et leurs Développements Modernes*, . . . edited by G. Julia (Paris, 1917)] by R. G. D. Richardson, 108–124; "Dickson's *History of the Theory of Numbers*" [review of Vol. I, Washington, 1919] by D. N. Lehmer, 125–132; "The calculus of probability" [review of G. Castelnuovo's *Calcolo delle Probabilità* (Milano-Roma-Napoli, 1919)] by R. D. Carmichael, 132–135; "Corrections," 136–137; "Notes," 136–141; "New publications," 142–144.

Bulletin of the Calcutta Mathematical Society, Volume 9, no. 2, March, 1919: "The late Sir Gooroodas Banerjee" by S. K. Banerji, i–v and portrait frontispiece ["By the death of Sir Gooroodas Banerjee, which melancholy event took place on the 2d of December, 1918, the Calcutta Mathematical Society has lost not only its senior Vice-President but one who took the deepest interest in all its proceedings, one whose great learning, splendid endowments of head and heart, deep piety, purity of character and loftiness of aims and principles were always object-lessons to its members. Manifold as were the activities of Sir Gooroodas Banerjee, his life is one of considerable interest to the mathematician. Sir Gooroodas began his life as a teacher of mathematics and ended it as an author of mathematical text-books. Whether as a lawyer, a judge, or an educationist, Sir Gooroodas owed, in no inconsiderable degree, his sound judgment, his accurate logic and his strong common sense to his high attainments as a mathematician.

"Sir Gooroodas was born on the 27th of January, 1844, in Narikeldanga, in the suburbs of Calcutta. . . . Many years ago he wrote a book on the Elements of Arithmetic and Algebra. For a long time he could hardly find time and leisure to pursue this favourite subject of his and it was only after his retirement from the Bench that he could renew his mathematical activities. . . . [He] brought out in 1906 his *Elementary Geometry* adapted to modern methods. This book is a small volume of 142 pages and comprises within its limits the substance of the first six books of Euclid and almost all the elementary propositions of Solid Geometry. The most attractive feature of the book is that a beginner can learn with ease and within a short time all the important elementary truths of Geometry. This book has already passed through several editions and can be seen in the hands of almost all our school-going boys. . . . Quite recently Sir Gooroodas formed an elaborate plan of bringing out a series of mathematical text-books in our own vernacular Bengali under the name *Saral Ganit* and published three parts dealing respectively with Arithmetic, Algebra, and Geometry based on modern methods. All three volumes are characterized by the same remarkable simplicity and conciseness which form the distinguishing features of his English treatise on Elementary Geometry"]; "On the figures of equilibrium of two rotating masses of fluid for the exponential potential e^{-kr}/r," Part 1 by A. Datta, 59–70; "Fourier's series and its influence on some of the developments of mathematical analysis" by A. C. Bose, 71–84 ["In the *Bulletin of the Calcutta Mathematical Society* (vol. 7, pp. 33–48), an account has been given of the Life and Work of Fourier. The present paper endeavours to state briefly how some of the concepts of modern mathematics of a far-reaching character, arose out of Fourier's Analysis, justifying P. E. B. Jourdain's remark that 'if it is safe to trace back to any single man the origin of those conceptions with which pure mathematical analysis has been chiefly occupied during the nineteenth century and up to the present time, we must, I think, trace it back to Jean Baptiste Joseph Fourier

(1768–1830).' . . . He died full of honours and to the infinite regret of his colleagues who had come to appreciate his eminence as a physicist and a mathematician. As Arago said 'his life had been so varied, so laborious, so gloriously interlaced with the greatest events of the most memorable epochs of French History, that the scientific discoveries of the illustrious Secretary [of the Academy of Sciences] had nothing to dread from the incompetence of the panegyrist.'

"We bow then to the greatness of Jean Baptiste Joseph Fourier and we greet him, in the 20th century, with the eloquent words of Sir William Rowan Hamilton, another great Mathematician whom Fourier charmed and inspired in writing of fluctuating functions:

"Fourier with solemn and profound delight,
Joy born of awe, but kindling momently
To an intense and thrilling ecstasy,
I gaze upon thy glory and grow bright:
As if irradiate with beholden light;
As if the immortal that remains of thee
Attune me to thy spirit's harmony,
Breathing serene resolve and tranquil might,
Revealed appear thy silent thoughts of youth,
As if to consciousness, and all that view
Prophetic, of the heritage of truth
To thy majestic years of manhood due:
Darkness and error fleeing far away,
And the pure mind enthroned in perfect day."];

"On the numerical calculation of the roots of the equations $P_n^m(\mu) = 0$ and

$$\frac{d}{d\mu} P_n^m(\mu) = 0$$

regarded as equations in n" by B. Pal, 85–95; "On some new theorems in the geometry of masses" by S. Dhar, 96–107; "On the electric resistance of a conducting spheroid with given electrodes" by S. Kar, 109–114—Volume 10, no. 1, June, 1919: "On surface waves and tidal waves near a promontory" by S. Banerji, 1–10; "On the potentials of uniform and heterogeneous elliptic cylinders at an external point" by N. Sen, 11–27; "Notes on inversion" by T. Bhattacharyya, 29–34; "On the use of Ritz's method for finding the vibration-frequencies of heterogeneous strings and membranes" by N. K. Majumdar, 35–42; "On the steady motion of a viscous fluid due to the rotation of two rigid bodies about arbitrary axes" by B. Dutt, 43–61; "Obituary Notices," 63 [1. The late Mr. Chandrashekkar Sircar; 2. The late Principal Ramendrasundar Trivedi]—No. 2, September: "New methods in the geometry of a plane arc. II—Cyclic points and normals" by S. Mukhopadhyaya, 65–72; "Origin of the Indian cyclic method for the solution of $Nx^2 + 1 = y^2$" by P. C. Sen-Gupta, 73–80 [First and last paragraphs: "The object of the present paper is to discuss the probable origin of the 'Cyclic Method' (*Chakrabala*) for the solution of $Nx^2 + 1 = y^2$ in rational integers as given in Bhaskara's *Vijaganita*. Two hypotheses have been advanced as regards its origin: first that the method has an ultimate Greek source and secondly that it is purely Indian. I shall first discuss the former view and shall next show that it is untenable in the light of the reasons which, I trust, are put forth herein for the first time. . . . It is thus seen that to arrive at the Indian cyclic rule it is not at all necessary to determine an approximation to $\sqrt{N}$ either by the Archimedian method or by any other method. It is further evident that the rules are immediate deductions from the lemma of Brahmagupta and the sole credit of finding a method for the solution of $Nx^2 + 1 = y^2$ belongs to him"]; "On the motion of an ellipsoid of revolution in a viscous fluid in the light of Prof. Oseen's objection to Stokes's treatment of the case of the sphere" by B. Pal, 81–94 ["The motion of a sphere in a viscous fluid has been investigated by various writers, including Stokes, Profs. Whitehead, Oseen, Lamb, Burgess, the results obtained being more or less satisfactory according to the degree of approximation to which the differential equations are satisfied.

"In the present paper, I propose (1) to obtain the solution of the problem of the motion of translation of an ellipsoid of revolution of small ellipticity in a viscous fluid, the method adopted being similar to that of Prof. Lamb for treating the corresponding problem in the case of the sphere, and (2) to show how the results obtained by me although different in some respects from those given by Oberbeck, the only important writer who investigated the ellipsoidal problem before me, are free from any objection similar to that pointed out by Prof. Oseen in Stokes's treatment of the spherical problem."]; "On a class of ellipsoidal harmonics and a method of

solving the wave equation in ellipsoidal coordinates" by S. Banerji, 95–104; "Some cases of tidal oscillations in canals of variable section" by S. Dasgupta, 105–116; "The stress-equations of equilibrium" by S. Basu, 117–121; Review by S. M. of Miller, Blichfeldt, and Dickson's *Theory and Applications of Finite Groups* (New York, 1916), 123–124.

Colorado College Publications, science series, volume 12, no. 3, 1907: "On the transformation of algebraic equations by Erland Samuel Bring (1786)," translated and annotated by F. Cajori, 63–90—No. 7, 1910; "A history of the arithmetical methods of approximation to the roots of numerical equations of one unknown quantity" by F. Cajori, 171–287—No. 15, November, 1919; "On non-ruled octic surfaces whose plane sections are elliptic" by C. H. Sisam, 639–655.

Creighton-Courier, Creighton University, Omaha, Nebraska, volume 8, No. 12, February 7, 1920: "Einstein's theory of gravitation" by W. F. Rigge, 2–3.

Educational Review, volume 59, January, 1920: "Mathematics as a study" by G. S. Painter, 19–40. [First paragraph: "It is a certainty that educational wisdom will not die with this generation. Never in our history perhaps have such perplexity and indecision prevailed as now relative to the ends and methods of education. Nothing is any longer simple or fixt; everything is in a state of flux. The parvenu educational iconoclast is abroad in the land, and with opprobrious assurance hesitates not to lay unholy hands upon our most sacred educational traditions and institutions. No science or subject of investigation is any longer of value in and of itself, but only in so far as it contributes to something else. The implicit motive back of all this attitude is one of vulgar utility which is regarded as the sole and only reason for the existence of anything. We are, then, somewhat in a state of educational anarchy in which, with characteristic unwisdom, the blind are leading the blind with the conventional result of all getting into the ditch."]

L'Enseignement Mathematique, volume 20, no. 5, October, 1919: "Sur une transformation élémentaire et sur quelques intégrales définies et indéfinies" by C. Cailler, 317–337; "Sur l'intégrale $n!\int_0^h \frac{h^n e^{-(hx/1-h)}}{1-h}\,dh$" by F. Vaney and M. Paschoud, 338–346; "Extension de la notion de Jacobien" by M. Stuyvaert, 347–354; "Sur la représentation proportionnelle en matière électorale" by G. Pólya, 355–379 [First paragraph: "Dans plusieurs périodiques non mathématiques,[1] j'ai essayé de mettre en contact l'analyse mathématique avec l'énorme diversité des opinions émises sur la question de la représentation proportionnelle en matière électorale. La partie la plus intéressante de la recherche est, me semble-t-il: trouver, dans une littérature de controverse qui s'éloigne beaucoup de l'exposition et des sujets mathématiques habituels, des principes tangibles, des faits susceptibles d'une explication exacte et les 'mettre en équation.' Dans les travaux cités j'ai énoncé plusieurs résultats mathématiques. Je les ai vérifiés expérimentalement par des exemples, j'ai tâché de les rapprocher du bon sens sans l'aide des formules, mais j'ai dû omettre les démonstrations. Dans les lignes suivantes, je donnerai l'analyse exacte, une analyse très élémentaire d'ailleurs, mais qui ne sera peut-être pas dépourvue d'un certain intérêt pour quelques lecteurs"]; "Mélanges et correspondance" ["Au sujet de la publication de mon article sur 'Les origines d'un problème inédit de E. Torricelli' (*L'Enseignement Mathématique*, vol. 20, pp. 245–268), je dois signaler que M. Michele Cipolla, professeur à l'Université de Catane, vient de faire paraître une important étude sur le même problème: Michele Cipolla, "I triangoli di Fermat e un problema di Torricelli," *Atti dell'Accademia Gioenia di scienze naturali in Catania*, serie 5, vol. 10, memoria XI . . ." Emile Turrière.]; "Chronique;" "Notes et documents;" Review by C. A. Laisant of G. Bouligand's *Cours de géométrie analytique* (Paris, 1919), 390–391; Review by A. Buhl of P. Boutroux's *Les principes de l'analyse mathématiques*, tome 2 (Paris, 1919), 391–392; Review by E. Turrière of F. C. Clapier's *Sur les surfaces minima ou élassoides* (Paris, 1919), 392–393; Review by A. Buhl of G. H. Halphen's *Œuvres*, and R. de Montessus de Ballore's *Introduction à la théorie des courbes gauches algébriques* (Paris, 1918), 393–397; "Bulletin Bibliographique."

Journal of Educational Research, University of Illinois, volume 1, no. 1, January, 1920: "Hurdles, a series of calibrated objective tests in first year algebra" by M. A. Dalman, 47–62.

Journal of the Indian Mathematical Society, volume 11, no. 5, October, 1919: "A problem of diophantine approximation" by G. H. Hardy, 162–166; "A general theorem

[1] *Schweiz. Zentralblatt für Staats- und Gemeindeverwaltung*, 1919, no. 1; *Journal de statistique suisse*, 1918, no. 4; *Wissen und Leben*, January and February, 1919. *Zeitschrift fur die gesamte Staatswissenschaft* (sous presse).

relating to the cartesian oval" by A. C. L. Wilkinson, 167–172; "Multiplication of infinite integrals" by K. B. Madhava, 173–180; "A proof of Bertrand's postulate" by S. Ramanujan, 181–182; "Astronomical notes" by T. P. Bhaskara Sastri, 183–184; Problems and solutions, 185–200; "Mathematics from periodicals" by V. B. Naik, i–v.

Mathematical Gazette, volume 9, October, 1919: "The graphical treatment of differential equations" by S. Brodetsky, 377–382 (to be continued) [*First two paragraphs:* "The subject of this paper is one that presented itself in a piece of work of a practical nature. The development of aeroplane flight naturally suggested the investigation of the motion of a body in a resisting medium. In general this problem was too difficult for solution. One therefore looked for legitimate means of simplifying it. One simple type of motion allied somewhat to areoplane motion was that of a plane lamina moving in air under the earth's attraction. Even here difficulties arose in the solution of the resulting equations of motion; yet further simplification was not permissible, for care had to be taken that the simplified problem did bear some relation to the actual problem presented by nature. It was ultimately found that the simplest possible form of the problem gave rise to the differential equation

$$\frac{dy}{dx} = -\frac{x}{y} - (x^2 + y^2)^{1/2},$$

or, putting $(x^2 + y^2)^{1/2} = r$,

$$\frac{dr}{dx} = -y.$$

The disconcerting feature about this equation was the fact that it was found to be quite insoluble by any of the 'standard forms' dealt with in books on differential equations. Several mathematicians tried to discover a 'transformation' or an 'integrating factor,' but without success. Yet a solution had to be found somehow.

"It then occurred to the writer that where analysis had failed, geometry might succeed. The solution of a differential equation of the first order is of course represented geometrically by a family of curves. The ordinary treatment of differential equations consists in seeking for an analytical representation of these curves. Since, then, the analytical formula was apparently unobtainable, might not the curves themselves be 'graphable'? The result was a complete success "]; "Coördinate geometry in schools" by W. J. Dobbs, 383–388 (to be continued); Reviews of F. S. Woods and F. H. Bailey's *Analytic Geometry and Calculus* (Boston, 1918), H. B. Phillips's *Differential and Integral Calculus* (New York, 1916–1917), H. Hancock's *Theory of Maxima and Minima* (Boston, 1917), H. Bateman's *Differential Equations* (London, 1918), and *Annuaire pour l'an* 1919, (Bureau des Longitudes, Paris, 1919) 389–391 [*Last paragraph of last mentioned review:* "The essays which are always a notable feature in the Annuaire, are this year by MM. Appell and Hamy. The former finds a congenial topic in 'The figures of relative equilibrium of a rotating homogeneous liquid' (60 pp.). After an historical sketch of the theory up to the work of the late MM. Liapounoff and Poincaré, he deals with the problem of stability and the phenomena at the point of bifurcation. The value of the paper is greatly enhanced by a full bibliography. M. Hamy treats of the inference of the real diameters of minor planets and satellites from a study of the interference fringes (27 pp.). He believes that, with the more powerful instrumental opportunities at our disposal in the 100 in. reflector at Mount Wilson, it will be quite possible to determine the angular-diameters of 1st magnitude stars. The excellent table of contents runs to 69 pp.].

Messenger of Mathematics, volume 48, no. 11, March, 1919: "The dissection of rectilineal figures "(conclusion) by W. H. Macaulay, 161–165; "On a Diophantine problem" (second paper) by H. Holden, 166–176—No. 12, April: "On a Diophantine problem" (conclusion) by H. Holden, 177–179; "Sur quelques intégrales definies" by S. P. Shensen, 179–184; "On n-poled cassinoids" by H. Hilton, 184–192 [The polar equation of the curve is $r^{2n} - 2r^n c^n \cos n\theta + c^{2n} = a^{2n}$].

Nature, volume 104, November 20, 1919: "Percussion figures in isotropic solids" by J. W. French, 312–314—November 27: "Gravitation and light" by O. J. Lodge, 334 [*The note:* "It may or may not have been noticed that the refractivity $(\mu - 1)$ at any point, required to produce the Einstein deflection, is the squared ratio of the velocity of free fall from infinity to the velocity of light."]; "A new astronomical model" by A. L. Cortie, 343–344. [*First paragraph:* "The illustrious scholar Gerbert (A.D. 940–1003), afterwards Pope under the name of Sylvester II., was apparently the first of the schoolmen who illustrated his theoretical lessons on astronomy by the use of globes, which he constructed with his own hands. About the year A.D. 1700 George

Graham invented a machine to show the movements of the earth and planets about the sun, a copy of which was made by Charles Boyle, the Earl of Orrery. Hence the name of an apparatus very useful for illustrating lessons in astronomy, although Sir John Herschel did call orreries 'very childish toys.' But surely the difficulty in teaching astronomy is to make the young pupil think in three dimensions. What are we going to do when the relativists would have us imagine phenomena in four dimensions?" *Last paragraph:* "Dr. Wilson is to be heartily congratulated on having produced such a valuable, workable astronomical model. So many science masters—excellent men!—have desired to acquire it that he has felt justified in putting it upon the market and getting it made in quantities. The price is 22*l.* net, carriage paid to any part of the United Kingdom. All communications regarding the model should be addressed to Dr. Wilson himself at 43 Fellows Road, London, N.W. 3."].—December 4: "Gravitation and light" by O. J. Lodge, 354; "The displacement of light rays passing near the sun" by A. Anderson, 354; "Einstein's relativity theory of gravitation" by E. Cunningham, 354–356; [Note], 360 ["The *Times* of November 28 contains an article from Prof. Einstein on his generalized principle of relativity. Prof. Einstein remarks at the beginning of the article: "After the lamentable breach in the former international relations existing among men of science, it is with joy and gratefulness that I accept this opportunity of communication with English astronomers and physicists. It was in accordance with the high and proud tradition of English science that English scientific men should have given their time and labour, and that English institutions should have provided the material means, to test a theory that had been completed and published in the country of their enemies in the midst of war.' After a brief account of the general nature of the theory, which does not add anything to what has been summarised by Prof. Eddington in his report to the Physical Society, Prof. Einstein concludes: 'The great attraction of the theory is its logical consistency. If any deduction from it should prove untenable, it must be given up. A modification of it seems impossible without destruction of the whole. No one must think that Newton's great creation can be overthrown in any real sense by this or any other theory. His clear and wide ideas will for ever retain their significance as the foundation on which our modern conceptions of physics have been built. . . . By an application of the theory of relativity to the taste of readers, to-day in Germany I am called a German man of science, and in England I am represented as a Swiss Jew. If I come to be regarded as a *bête noire*, the descriptions will be reversed.' Prof. Eddington, in the *Contemporary Review*, quotes from Newton's *Opticks:*—'Query 1. Do not bodies act upon light at a distance, and by their action bend its rays?'"]; [Einstein theory at the anniversary meeting of the Royal Society], 361–362.—December 11: "Gravitation and light" by O. J. Lodge, 372 ["Jupiter ought just to show the Einstein deflection, for if it pass between two stars a couple of diameters of the planet apart, their temporary relative displacement will be a 'third' of arc, the sixtieth of a second; and this could be measured with a heliometer"]; "The deflection of light during a solar eclipse" by A. S. Eddington and A. C. D. Crommelin, 372–373; "Einstein's relativity theory of gravitation. II—The nature of the theory" by E. Cunningham, 374–376—December 18: Review by S. Brodetsky of Maria M. Roberts and Julia T. Colpitts's *Analytic Geometry* (New York, 1918), P. Goyen's *Elementary Mensuration, constructive plane geometry, and numerical Trigonometry* (London, 1919) and J. B. Shaw's *Lectures on the Philosophy of Mathematics* (Chicago, 1918), 390–391; "Deflection of light during a solar eclipse" by W. H. Dines, L. F. Richardson, and A. Anderson, 393–394. "Einstein's relativity theory of gravitation. III.—The crucial phenomena" by E. Cunningham, 394–395.—January 22, 1920: "Gravitation and light" by J. Larmor, 530; "The Einstein theory and spectral displacement," two notes by H. F. Moulton and A. C. D. Crommelin, 532—January 29; "The works of Toricelli" by J. L. E. D., 557–558; "The deflection of light during a solar eclipse" by A. Anderson, 563; "Displacement of spectral lines" by R. W. Lawson, 565 ["In view of the discussion in *Nature* and elsewhere on this subject, the following extract from a recent letter of Prof. Einstein may be of interest: 'Zwei junge Physiker in Bonn haben nun die Rot-Verschiebung der Spektral-Linien bei der Sonne so gut wie sicher nachgewiesen und die Gründe des bisherigen Misslingens aufgeklärt.' I have heard no details, but doubtless an account of this work will be available before long"]—February 5: "The predicted shift of the Fraunhofer lines," by J. Rice and A. S. Eddington, 598–599; "The straight path" by A. A. Robb, 599; "Mathematics in the United States" by G. B. M[athews], 601—February 12: "Euclid, Newton, and Einstein" by W. G., 627–630; "The theory of relativity" by A. C. D. Crommelin, 631–632.

PHILOSOPHICAL MAGAZINE, volume 38, November, 1919: "The Bessel-Clifford function and its applications" by G. Greenhill, 501–528.

Revue de l'Enseignement des Sciences, volume 12, November–December, 1918 (published February, 1919): "Le cas singulier des fonctions implicites et les enveloppes dans le plan" by G. Bouligand, 225–237; "Sur le dessin géométrique" by C. Bioche, 238–240; "Sur le deuxième principe fondamental de la méthode infinitésimale" by G. Lapointe, 240–243; "Notes de géométrie analytique" by C. Michel, 243–249; "Des différents systèmes de numération. Propriétés des nombres dans ces divers systèmes" (suite) by R. Massart, 249–259 [Paragraphs 47–59; the article was started in the first number of the volume]; "Correspondance," 259; "Examens et concours de 1918," 260–266—Volume 13, January–February, 1919 (published, May): "Sur la loi exponentielle d'erreur, les séries d'observations et la moyenne arithmétique dans les sciences physiques" by L. Genillon, 1–11; "Sur les ovals de Descartes" by L. Genillon, 11–18; "Une propriété de la parabole" by J. Lemaire, 23–26; "Sur une surface réglée du quatrième ordre" by J. Lemaire, 27–30; "Sur les systèmes de numération et le calcul des polynomes" by J. Juhel-Rénoy, 30–33; "Des différents systèmes de numération. Propriétés des nombres dans ces divers systèmes" (suite et fin) by R. Massart, 33–43; "Examens et concours de 1918," 43–64—March–April: "Les trois dispositions de deux trièdres supplémentaires" by G. Fontené, 65–68; "Sur un procédé de calcul et son application à la topographie" by T. Leconte 68–88; "Sur les rayons de courbure et les normales polaires" by C. Bioche, 88–90; "La rotation et le quadrilatère inscriptible" by Amsler, 90–92; "Problèmes de mathématiques et de physiques donnés au baccalauréat, 1918," 93–95, 109–118.

Revue de Philosophie, volume 19, no. 5, September–October, 1919: "L'infini mathématique" (second article) by P. M. Périer, 516–533.

Scientia, volume 26, December, 1919: "Il posto di Leonardo nella storia delle scienze" by A. Favaro, 437–448, supplément 137–149; Review by G. Loria of M. Bôcher's *Leçons sur les méthodes de Sturm dans la théorie des équations différentielles linéaires* (Paris, 1917).

Scientific Monthly, volume 9, no. 6, December, 1919: "Our universe of stars" by E. Doolittle, 506–513; "Individuality in research" by R. D. Carmichael, 514–525 [*First paragraph:* "The men of no other country have exhibited so great a measure of individuality in research as those of England. In the highest degree they have manifested the self-reliant strength of natural genius. Among them scientific endeavor has not been organized; and for the most part investigations have been carried out by single workers in isolation. British science has always refrained from congregating in distinct schools and institutions; it has never been localized in definite centers. No compact body of pupils there develops the work and ideas of any master. Thinkers proceed singly and individually with their self-appointed tasks laboring in close touch with nature and according to their particular inclinations."]—Volume 10, no. 3, March, 1920: "Space, time and gravitation" by E. B. Wilson, 217–235 [Read before the Royce Club, Boston, January 18, 1920]; "Finis coronat opus" by F. V. Morley, 306–308 [First paragraph: "The evening vigil may be approached in many ways. Perhaps the pleasantest of all is to fortify the soul with plenty of tobacco, a canister of crackers and something potable to fall back upon, and a volume of the inimitable Robert Burton. But failing the 'merry companionship' of the younger Democritus, we should be prone to choose the scientific remains of a poor, neglected, and forgotten scholar whose name was also Robert [Recorde], but who was earlier in his unhappy life at Oxford by some fifty years"].

Theosophical Path, Point Loma, Cal., volume 18, no. 2, February, 1920: "Neglected foundations of geometry" by F. J. Dick, 160–171 [Last paragraph: "To go on telling people that it is impossible to 'square the circle' by the plane geometry of line and circle is surely as absurd as the evaluation of π (actually accomplished) to 700, or even to 30 decimal places, seeing that no radius, whether it be the 'astronomical unit' or the radius of an engine-cylinder, is ever known with greater accuracy than that defined by the fifth or sixth significant figure, at the most."]

Transactions of the American Mathematical Society, volume 20, no. 4, October, 1919 (published January, 1920): "Line-geometric representations for functions of a complex variable" by E. J. Wilczynski, 271–298; "On the combination of non-loxodromic substitutions" by E. B. Van Vleck, 299–312; "On a general class of integrals of the form $\int_0^\infty \phi(t)g(x+t)dt$" by R. D. Carmichael, 313–322; "Transformations of surfaces applicable to a quadric" by L. P. Eisenhart, 323–338; "Note on two three-dimensional manifolds with the same group" by J. W. Alexander, 339–342; "A general system of linear equations" by Anna J. Pell, 343–355; Errata, 356; Index by authors, index by subject matter, volumes 11–20, 31 pp. [There are 137 authors. Ten papers are listed under the heading, "Logical analysis of mathematical disciplines;" thirty-

eight under the heading "Algebra"; thirteen under "Theory of numbers"; one hundred and twenty under "Analysis"; twenty-nine under "Groups"; seventy-six under "Geometry"; twelve under "Applied mathematics."]—Volume 21, no. 1, January, 1920: "The strain of a gravitating sphere of variable density and elasticity" by L. M. Hoskins, 1–43; "The geometry of hermitian forms" by J. L. Coolidge, 44–51; "Certain types of involutorial space transformations" by F. R. Sharpe and V. Snyder, 52–78.

AMERICAN DOCTORAL DISSERTATIONS.

E. F. Simonds, "Invariants of differential configurations in the plane," *Transactions of the American Mathematical Society*, 1918, volume 19, pp. 222–250 (Columbia, 1917).

UNDERGRADUATE MATHEMATICS CLUBS.

Edited by U. G. Mitchell, University of Kansas, Lawrence.

CLUB TOPICS.

Although much has already been printed concerning the abacus and its uses,[1] we believe that our readers will find the following article by Professor Leavens decidedly interesting and helpful since it gives an independent discussion based upon the personal impressions and first-hand information of a westerner who has come into contact with the present-day use of the abacus in the far east.

17. The Chinese Suan P'an.

By Dickson H. Leavens, College of Yale in China.

The Chinese suan p'an[2] or abacus is familiar to many from an occasional sight of it on a laundryman's table, but it is perhaps usually regarded either as a device full of the mystery of the East and beyond the grasp of the Occidental, or as an instrument fit only for the ignorant "Celestial" and beneath the notice of one who has studied arithmetic.

A little investigation, however, will show one that it is not only perfectly

[1] Two of the best discussions in English are probably C. G. Knott's article, cited below, and Leslie's *Philosophy of Arithmetic* (Edinburgh, 1820), pp. 15–100. Leslie gives, in great detail, examples of the representation of numbers in different scales of notation and of operations by means of them. From his discussion one can readily see how certain theorems on divisibility of numbers and even the summation of special infinite descending series may be inferred from the use of the abacus.

Some excellent illustrations and references to the literature of the abacus can be found in Smith and Mikami's *History of Japanese Mathematics* cited below. Other readily accessible sources of information are the descriptions given in current histories of mathematics and articles in encyclopedias under the titles "Abacus" and "Calculation."

[2] In this Monthly (1919, 256), it is noted that this word, with various spellings, appears in the *New English Dictionary*, but that "the Chinese word Soroban . . . is not given." Soroban, however, is not Chinese, but Japanese, being the Japanese pronunciation of the same characters, which are used in the written language of both countries.

The same note (following the dictionary) translates suan p'an wrongly as reckoning *board*. The Chinese character for board is romanized pan, hence the error; but it is quite a different character from the one here used, which means a *plate* or *tray;* the pronunciation is also different, p in the most used system of romanization representing practically our b, while p' is similar to our p.